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A Session Initiation Protocol (SIP) INFO package for Private Wire
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Abstract

Application level data exchanged using the SIP INFO method are supported and documented in specifications known as 'INFO Packages'. This document defines functionality associated with Session Initiation Protocol (SIP) Private Wire functionality and creates an 'INFO Package' for carrying such application level data.

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SIP INFO Package for Private Wire

January 2014

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[1.](#) Introduction

Private Wire (PW) is a generic term used to describe static point to point voice connections between two locations. Private Wires are used by a number of communities such as Military, Railways, 911/999 Services and Financial Services. This document will primarily deal with the Financial Services Industry however it should be equally

applicable to other communities.

The aim is to define a SIP based emulation of existing Private Wire circuits so that interoperability can be attained between existing

digital and analogue equipment and the new generation of SIP based technology.

This document does not seek to add functionality above the existing Private Wire experience or to define new financial services that may be possible using SIP interconnections between trading systems.

Financial Institutions are traditional early adopters of telecommunications technology. The phone became so important that any loss of service could result in huge losses in the markets. Traders and brokers in particular were quick to realise some of the short comings of PSTN interconnection when used for voice trading, such as:-

- o Slow speed of dialling especially with rotary dials.
- o Slow speed of connection which could lead to missing first part of conversation.
- o No ability for their calls to be given high priority in the PSTN so calls would not get through.
- o Far end was on a call to someone else and so would not answer.

To solve these issues the financial communities took advantage of the fact that their offices in any given location were very close to all the offices of their trading partners and started to run direct private connections between themselves.

It is the intention of this document to create SIP based Private Wire functionality that will enable new systems to provide equivalent functionality in an interoperable form. This includes interoperation with legacy systems.

A SIP based solution uses core SIP functionality to enable a device compliant to this specification to signal information specifically

related to a Private Wire. In its most simplistic form the SIP signalling, as illustrated in Figure 1, representing a Private Wire is re-used with extensions defined in this specification which imitates legacy functionality (intermediaries left out for simplicity).

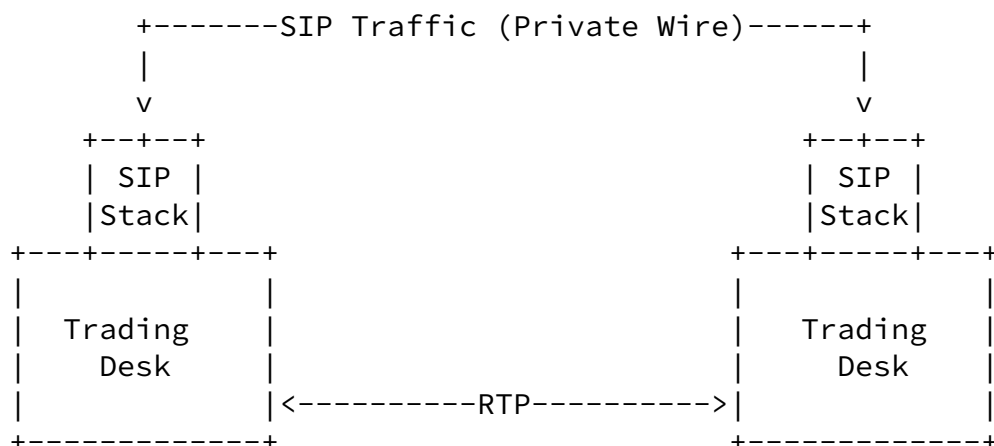
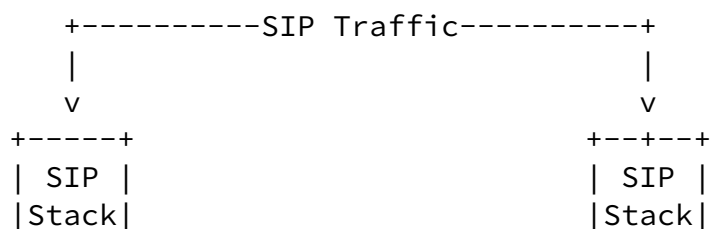


Figure 1: SIP Private Wire

While it is envisioned that all existing deployments will move to a SIP based solution it must be recognised that the majority of deployments using this specification will be interacting with legacy Private Wire systems for the foreseeable future, as illustrated in Figure 2.



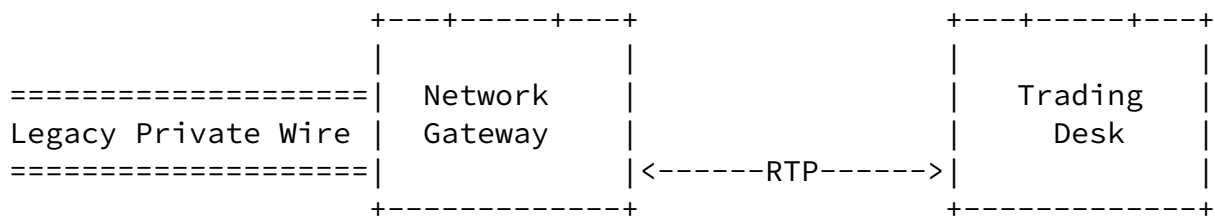


Figure 2: Legacy Private Wire

This specification will define a Session Initiation Protocol (SIP) INFO package, as defined in [RFC6086], for the purpose of mid call signalling related to Private Wire functionality. The remainder of this specification will define the appropriate level of detail from both a functional and standardisation perspective.

2. Conventions and Terminology

In this document, [BCP 14](#)/RFC 2119 [RFC2119] defines the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL". In addition, [BCP 15](#) indicates requirement levels for compliant implementations.

The following additional terms are defined for use in this document:

Private Wire (PW) : generic term used to describe static point to point communication connections between two locations.

3. Overview of Operation

The use of Session Initiation Protocol (SIP) for Private Wire communication allows for migration of existing functionality and deployments. It also provides an appropriate foundation for future extensions to enhance Private Wire functionality.

A SIP Private Wire will make use of existing SIP standards as well as the extensions defined in this document - as covered in the remainder

of this section.

A SIP based Private Wire will be established as any other INVITE dialog specified in [RFC 3261](#) [[RFC3261](#)] with the following additional steps:

- o On constructing the initial INVITE request the User Agent Client (UAC) MUST include a SIP 'Recv-info' header (as defined in [[RFC6086](#)] with a value of 'pw-info-package'. The 'pw-type' parameter MUST also be included with an appropriate value.
- o On constructing a reliable response (as defined in [[RFC3261](#)]) to the INVITE request the SIP 'Recv-info' header MUST be included with a value of 'pw-info-package'. The 'pw-type' parameter MUST also be included with an appropriate value. An entity receiving a SIP INVITE request/response MUST NOT issue commands for this INFO package if the SIP 'Recv-info' header is not present.
- o All SIP INFO messages defined in this package for Private Wire signalling MUST contain the SIP 'Info-Package' header with a value of 'pw-info-package'.

A SIP entity that receives a Private Wire SIP INVITE request for a domain that it controls (appears in the host part of the SIP URI) but does not recognise the user part MUST issue a SIP 404 response if no other routing path is defined. A SIP entity that receives a Private

Wire SIP INVITE request for a domain that it controls (appears in the host part of the SIP URI) but has definitive knowledge that the Private Wire is out of service, MUST issue a SIP 480 response. Overlapping SIP INVITE transactions MUST be treated as per described in [Section 3.1](#).

The INVITE dialog establishing a SIP Private Wire MUST comply to appropriate security procedures as set out in [Section 4](#). A SIP Private Wire SHOULD use TCP as the signalling protocol but MAY choose to use an alternative transport protocol if appropriate.

A SIP endpoint configured to initiate a SIP Private Wire MUST also support the 'Session Timer' extension as specified in [RFC 4028](#) [[RFC4028](#)]. It is important that a SIP Private Wire is always available and so early detection of failure is important to the

service. A SIP endpoint initiating a SIP Private wire should pick a refresh interval in association with [\[RFC4028\]](#) that is suitable for the system. A refresh interval of 120 seconds is RECOMMENDED. On detection of failure, a SIP endpoint MUST attempt to re-establish the SIP Private Wire immediately.

While an active SIP based Private Wire is established, a user may wish to signal certain events to the far end of the SIP INVITE dialog. To achieve the SIP INFO method is used in association with the INFO Package defined in this specification. More specifically, an endpoint wishing to signal Private Wire related information to the receiving end MUST comply to the SIP INFO package specification defined in [Section 4](#). This primarily involves the ability to:

- o Signal 'On Hook' and 'Off Hook' state.
- o Signal 'Ringdown' state (play locally configured alert).
- o Provide Transmission Only Service(TOS) Private Wire.

A SIP endpoint not compliant to this specification can still successfully interoperate with a compliant device but will not be able to take advantage of the specific Private Wire functionality defined in this document.

[3.1](#). Overlapping Requests

In the event that two endpoints actively attempting to connect a Private Wire call at the same time, an endpoint should be able to detect and resolve this situation. On receiving an incoming request to a well known Private Wire identifier the endpoint MUST check to see if it has an active INVITE transaction for the same Private Wire. If the endpoint does have an active INVITE transaction it MUST:

- o Generate a SIP 486 Busy Here response to the incoming INVITE transaction associated with the Private Wire.
- o Include a SIP 'Retry-After' header[RFC3261] in the 486 with an appropriate value which should reflect a point in the future when a new attempt might succeed. As a guideline this figure should be greater than the remaining amount of time left for the current outgoing Private Wire INVITE transaction.

- o Include a SIP Reason header[RFC3261] in the 486 with the value 'Reason: SIP;cause=486;text="Overlapping PW Establishment"'.

[3.2.](#) Incorrect Private Wire Type

A SIP INVITE compliant to this specification MUST include a 'Recv-Info' header, as defined further in [Section 6](#). An endpoint receiving a 'Recv-Info' header with a value that is not supported should respond with a SIP '469 Bad Info Package', as defined in [[RFC6086](#)].

[4.](#) Private Wire Package Definition

[4.1.](#) Overall Description

An Overall Description of the Private Wire INFO package can be found in [Section 3](#).

[4.2.](#) Applicability

The SIP INFO package mechanism was chosen for the purpose of carrying Private Wire application level information as it offered the most appropriate solution. Using a SIP INFO package encourages signalling to be viewed by appropriate intermediaries in Trading System architectures.

[4.3.](#) INFO Package Name

This document defines a SIP INFO Package as defined in [[RFC6086](#)]. The INFO Package token name for this package is "pw-info-package".

[4.4.](#) INFO Package Parameters

This document defines a single INFO package parameter. See [Section 6](#) for the definition of the 'pwtype' INFO package parameter.

[4.5.](#) SIP OPTION tags

See [Section 7](#).

[4.6](#). INFO Message Body Parts

A client conforming to this specification MUST include a compliant payload in a SIP INFO message that conforms to the XML schema defined in [Section 9](#). The MIME type MUST be of type 'application/pw-info+xml' as defined in [Section 12.1](#).

[5](#). Element Definitions

This section defines the XML elements for this package. The elements are defined in the XML namespace specified in [Section 9](#).

The root element is <pwSignal>. All other elements are contained within it. Child elements are <ringDown> and <hookSwitch>. The <ringDown> element is described in [Section 5.1.1](#). The <hookSwitch> element is described in [Section 5.1.2](#).

Implementations of this specification MUST address the Security Considerations described in [Section 11](#). Implementations of this specification MUST adhere to the syntax and semantics defined in this section and the schema in [Section 9](#). If there is a difference in constraints between the XML schema and the textual description of elements in this section, the textual definition takes priority.

The XML schema supports extensibility by allowing attributes and elements from other namespaces. Implementations MAY support additional capabilities by means of attributes and elements from other (foreign) namespaces. Attributes and elements from foreign namespaces are not described in this section.

[5.1](#). <pwSignal>

The <pwSignal> element has no attributes in addition to the standard XML namespace attributes such as xmlns.

The <pwSignal> element has two child elements of which only one can occur per message.:

- o <ringDown> – defined in [Section 5.1.1](#).
- o <hookSwitch> – defined in [Section 5.1.2](#).

[5.1.1.](#) <ringDown>

The <ringDown> element is used to request a local 'ringdown' alert at the remote party of the private wire.

The <ringDown> element has the following attributes:

- o signal: conveys an alert on the associated private wire. Contains a single value of 'ring'. The value 'ring' informs the remote client to alert the user based on a locally defined ring cadence and duration. NOTE: There is no signal to signify the end of ringing, this is a characteristic to be defined by the remote system

The <ringDown> element has no child elements.

[5.1.2.](#) <hookSwitch>

The <hookSwitch> element is used to convey a 'hookSwitch' alert to the remote party of the private wire.

The <hookSwitch> element has the following attributes:

- o signal: conveys the state of the associated private wire. Values can either be 'onHook' or 'offHook'. The value 'onHook' to signal 'not in use' on a private wire. The value 'offHook' to signal 'in use' on a private wire.

The <hookSwitch> element has no child elements.

[6.](#) 'pwtype' INFO Package Parameter

The Info package specification allows individual packages to define parameters for the 'Recv-Info' and 'Info-Package' header. This document defines one new event package parameter: pw-type.

A single instance of the 'pw-type' parameter MUST be included with a 'Recv-Info' header to convey the type of private wire being used for the SIP dialog. The value of 'pw-type' can either be 'ringdown', 'hookswitch' or 'TOS'. By specifying a value of 'ringdown' in the 'pw-type' parameter the <ringDown> element MUST be used from [Section 9](#). By specifying a value of 'hookswitch' in the 'pw-type' parameter the <hookSwitch> element MUST be used from [Section 9](#). By specifying 'TOS'(Transmission Only Service) no additional signalling is used in complying with this specification (future specifications may provide additional functionality). TOS is normally used for

interconnecting voice systems that need no signalling and are always assumed to be connected. An example might be TV audio or a Hoot

line. This type of circuit is normally internal to an organisation to interconnect groups both globally and regionally. In future, newer Private Wire networks will be able to offer this type of service between organisations. Once the 'pw-type' parameter is set in the initial INVITE request it MUST not be changed for the duration of the SIP INVITE dialog. An entity receiving a request with a 'pw-type' parameter that is not supported MUST respond with a SIP 4XX response. An entity receiving a reliable SIP response that contains a 'pw-type' parameter that is not supported MUST terminate the SIP dialog as immediately as per [RFC 3261](#) [[RFC3261](#)]. An entity receiving a SIP INFO message containing an incorrect element associated with the 'pw-type' MUST respond with a SIP 4XX response and ensure the associated SIP INVITE dialog is terminated.

The ABNF for the 'pw-type' parameter is shown below.

```
pw-type    = "pw-type" EQUAL pwtype
pwtype     = "ringdown" / "hookswitch" / "TOS"
```

Figure 3

[7.](#) SIP OPTIONS Tag

The Info package specification allows individual packages to define a SIP OPTIONS tag to enable discovery of support for this specification.

SIP entities generating an offer or answer that uses the Private Wire INFO package MUST place the 'pw-info-package' option-tag in a SIP Supported header field. When responding to, or generating a SIP OPTIONS request a SIP entity MUST include the 'pw-info-package' in a SIP Supported header field. SIP entities that support the Private Wire INFO package MUST understand the 'pw-info-package' option-tag.

[8.](#) Example Exchange

The following example provides a simple exchange between a Network Gateway (NWG) and a SIP based Trading Desk.

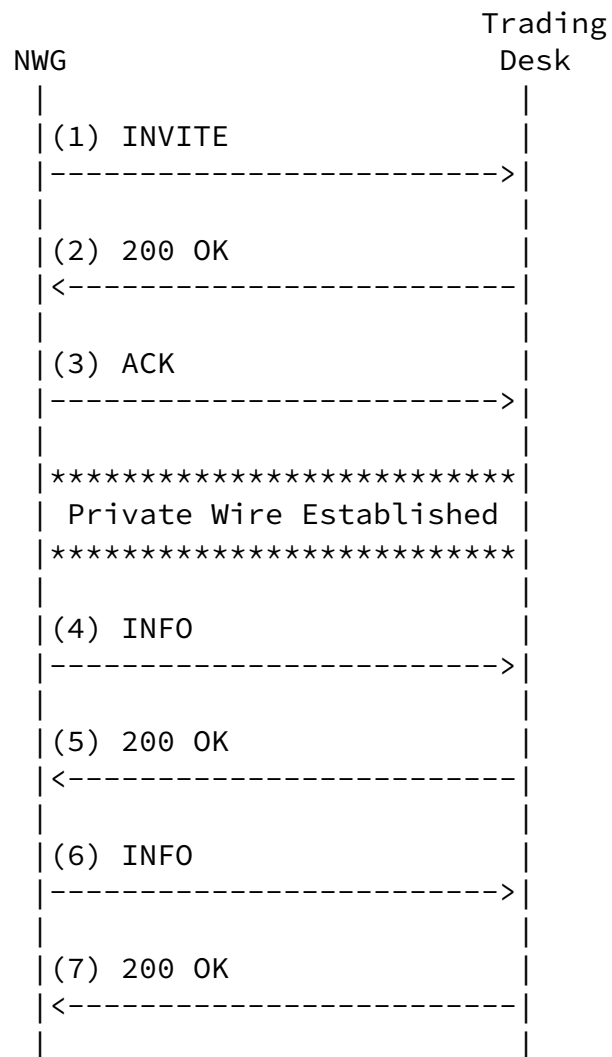


Figure 4

The example in this section represents an interaction between a Network Gateway (NWG) and a SIP enabled Trading desk. The remainder of this section provides more detail relating to Figure 4. Some detail has been left out for simplicity.

The NWG sends an initial INVITE (1) request. The INVITE request indicates that it is willing to receive SIP INFO requests for the Private Wire package.

```
INVITE sip:pw@example.com SIP/2.0
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK1
Max-Forwards: 70
To: PW <sip:pw@example.com>
From: Bank <sip:bank@example.com>;tag=100
Call-ID: abcd1234@pc1.example.com
CSeq: 1 INVITE
Supported: pw-info-package
Recv-Info: pw-info-package;pw-type=hookswitch
Contact: <sip:bank@pc1.example.com>
Content-Type: application/sdp
Content-Length: ...
```

...

The Trading Desk responds with a 200 OK(2) response. The 200 OK response indicates that it is willing to receive SIP INFO requests for the Private Wire package.

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK1;received=192.0.2.1
To: PW <sip:pw@example.com>;tag=200
From: Bank <sip:bank@example.com>;tag=100
Call-ID: abcd1234@pc1.example.com
```

CSeq: 1 INVITE
Contact: <sip:trader@pc2.example.com>
Supported: pw-info-package
Recv-Info: pw-info-package;pw-type=hookswitch
Content-Type: application/sdp
Content-Length: ...

...

The NWG sends an ACK(3) request to complete the INVITE transaction.

ACK sip:trader@pc2.example.com SIP/2.0
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK2
Max-Forwards: 70
To: Bob <sip:bob@example.com>;tag=200
From: Alice <sip:alice@example.com>;tag=100
Call-ID: abcd1234@pc1.example.com
CSeq: 1 ACK
Content-Length: 0

The NWG sends an INFO(4) request. The INFO request contains a 'pw' package payload signalling 'off hook'.

INFO sip:trader@pc2.example.com SIP/2.0
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK3
Max-Forwards: 70
To: Bob <sip:bob@example.com>;tag=200
From: Alice <sip:alice@example.com>;tag=100
Call-ID: abcd1234@pc1.example.com
CSeq: 2 INFO
Info-Package: pw-info-package
Content-type: application/pw-info+xml
Content-Disposition: Info-Package
Content-Length: 109

```
<pwSignal xmlns="urn:tradingsystems:params:xml:ns:private-wire:0">
  <hookSwitch signal="offHook"/>
</pwSignal>
```

The Trading Desk sends a 200 OK(5) request.

SIP/2.0 200 OK
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK3
Max-Forwards: 70
To: Bob <sip:bob@example.com>;tag=200
From: Alice <sip:alice@example.com>;tag=100
Call-ID:abcd1234@pc1.example.com
CSeq: 2 INFO
Content-Length: 0

The NWG sends an INFO(6) request. The INFO request contains a 'pw' package payload signalling 'on hook'.

INFO sip:trader@pc2.example.com SIP/2.0
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK4
Max-Forwards: 70
To: Bob <sip:bob@example.com>;tag=200
From: Alice <sip:alice@example.com>;tag=100
Call-ID:abcd1234@pc1.example.com
CSeq: 3 INFO
Info-Package: pw-info-package
Content-type: application/pw-info+xml
Content-Disposition: Info-Package
Content-Length: 108

```
<pwSignal xmlns="urn:tradingsystems:params:xml:ns:private-wire:0">
  <hookSwitch signal="onHook"/>
</pwSignal>
```

The Trading Desk sends a 200 OK(7) request.

SIP/2.0 200 OK
Via: SIP/2.0/TCP pc1.example.com;branch=z9hG4bK4
Max-Forwards: 70
To: Bob <sip:bob@example.com>;tag=200
From: Alice <sip:alice@example.com>;tag=100
Call-ID: abcd1234@pc1.example.com
CSeq: 3 INFO
Content-Length: 0

9. Formal Syntax

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="urn:bt-trs:params:xml:ns:private-wire:0"
  xmlns="urn:bt-trs:params:xml:ns:private-wire:0"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified"
  version="0.1">

  <xsd:annotation>
    <xsd:documentation xml:lang="en">Version 0.1 Draft XML schema
      for Private Wire Signalling in SIP INFO body
    </xsd:documentation>
  </xsd:annotation>

  <!--
    #####

    TOP LEVEL ELEMENT: pwSignal

    #####
  -->

  <!-- pwSignal -->

  <xsd:complexType name="pwSignallingType">
    <xsd:sequence>
      <xsd:choice>
        <xsd:element ref="ringDown" />
        <xsd:element ref="hookSwitch" />
        <xsd:any namespace="##other" minOccurs="0"
          maxOccurs="unbounded" processContents="lax" />
      </xsd:choice>
    </xsd:sequence>
    <xsd:anyAttribute namespace="##other" processContents="lax" />

    </xsd:complexType>

    <xsd:element name="pwSignal" type="pwSignallingType"/>
```



```

<!-- ringDown -->

<xsd:complexType name="ringDownType">
  <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
  </xsd:sequence>
  <xsd:attribute name="signal" type="ringDownSignalType"
    use="required"/>
  <xsd:anyAttribute namespace="##other" processContents="lax" />
</xsd:complexType>

<xsd:element name="ringDown" type="ringDownType"/>

<!-- hookSwitch -->

<xsd:complexType name="hookSwitchType">
  <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
  </xsd:sequence>
  <xsd:attribute name="signal" type="hookSwitchSignalType"
    use="required"/>
  <xsd:anyAttribute namespace="##other" processContents="lax" />
</xsd:complexType>

<xsd:element name="hookSwitch" type="hookSwitchType"/>

<!--

#####

DATATYPES

#####
-->

<xsd:simpleType name="ringDownSignalType">
  <xsd:restriction base="xsd:token">
    <xsd:enumeration value="ring"/>
  </xsd:restriction>
</xsd:simpleType>

<xsd:simpleType name="hookSwitchSignalType">

```

```
<xsd:restriction base="xsd:token">
  <xsd:enumeration value="onHook"/>
  <xsd:enumeration value="offHook"/>
</xsd:restriction>
</xsd:simpleType>

</xsd:schema>
```

[10.](#) Legacy Interoperation

The existing install base of PW are made up of E1/T1 CAS or analogue circuits and in order to interoperate with the legacy equipment a gateway function is required. There are a number of different signalling types in use and it will be the job of the gateway to map the legacy signalling to the proposed SIP INFO messages.

A number of gateways that exist have solved this problem using [RFC 2833](#) [[RFC2833](#)] which allows call events on trunks to be sent in the media plane as RTP packets. Gateway devices or Session Border Controller (SBC) devices implementing this new SIP based signalling should to be able to inter operate with this standard and to be able to translate between the two worlds.

[11.](#) Security Considerations

Security Considerations to be included in later versions of this document.

[12.](#) IANA Considerations

[12.1.](#) application/pw-info+xml MIME type

This section registers the "application/pw-info+xml" MIME type.

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To: ietf-types@iana.org
Subject: Registration of MIME media type
 application/pw-info+xml
MIME media type name: application
MIME subtype name: pw-info+xml
Required parameters: (none)
Optional parameters: charset
 Indicates the character encoding of enclosed XML. Default is UTF-8.
Encoding considerations: Uses XML, which can employ 8-bit characters, depending on the character encoding used. See [RFC 3023 \[RFC3023\], section 3.2](#).
Security considerations: No known security considerations outside of those provided by the Private Wire SIP INFO Package.
Interoperability considerations: This content type provides constructs for the Private Wire SIP INFO Package.
Published specification: RFC XXXX [NOTE TO IANA/RFC-EDITOR: Please replace XXXX with the RFC number for this specification.]
Applications which use this media type: Implementations of the Private Wire SIP INFO package.
Additional Information: Magic Number(s): (none)
 File extension(s): (none)
 Macintosh File Type Code(s): (none)
Person & email address to contact for further information: Chris Boulton <chris@ns-technologies.com>
Intended usage: LIMITED USE
Author/Change controller: The IETF
Other information: None.

[12.2.](#) pw-info-package SIP OPTIONS tag

This section defines a new SIP option tag per the guidelines in [Section 27.1 of RFC 3261 \[RFC3261\]](#).

Name: pw-info-package

Description: This option tag is used to identify the Private Wire INFO package extension. When present in a Require header field, it indicates that Private Wire is

required by a receiving client.

[13.](#) Change Summary

This section will document changes made in future versions.

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[14.](#) Acknowledgements

The authors would like to thank John Stafford and David Cohen of BT for their input.

[15.](#) Normative References

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